

JAPANESE [JP,2002-077280,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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**CLAIMS**

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[Claim(s)]

[Claim 1] It is transmission data by which digital quadrature modulation was carried out to the predetermined carrier signal. The transmission data which hierarchized the same contents of information to the transmission data (low hierarchy transmission data) of a modulation technique with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency, and a coding method and transmission efficiency, and a coding method, and were transmitted A C/N detection means to detect the carrier power pair noise power ratio (C/N ratio) of an input signal in the receiving set to receive, It has a decode means to switch alternatively the Takashina layer transmission data and low hierarchy transmission data from the transmission data to which recovered transmission data from the input signal and it restored according to the above-mentioned C/N ratio, and to decode information. The above-mentioned decode means switches the transmission data decoded when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. The receiving set characterized by switching the transmission data decoded when having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above to the Takashina layer transmission data.

[Claim 2] The above-mentioned decode means is a receiving set according to claim 1 characterized by switching the transmission data to decode to the Takashina layer transmission data when having decoded low hierarchy transmission data and the period when the above-mentioned C/N ratio became more than the 2nd threshold carries out predetermined time continuation.

[Claim 3] The above-mentioned decode means is a receiving set according to claim 1 characterized by switching the transmission data to decode to low hierarchy transmission data when having decoded the Takashina layer transmission data and the period which became that the C/N ratio became below the 1st threshold carries out predetermined time continuation.

[Claim 4] When the 1st carries out period continuation, the period when the above-mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy transmission data the above-mentioned decode means The transmission data to decode are switched to the Takashina layer transmission data. The receiving set according to claim 1 characterized by switching the transmission data decoded when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above which became that the C/N ratio became below the 1st threshold carries out period continuation to low hierarchy transmission data.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the receiving set used for example, for BS digital broadcasting etc.

[0002]

[Description of the Prior Art] In recent years, digital broadcasting, such as digital-communication satellite broadcasting service (CS digital broadcasting), digital satellite broadcasting (BS), and land-based digital broadcasting, is proposed as new broadcast media.

[0003] In such digital broadcasting, when a C/N (carrier power / noise power) ratio falls according to causes, such as weather aggravation, the so-called block noise occurs, decode of an image or a sound signal cannot be performed, but the problem that the output of an image or a sound signal gets worse arises.

[0004] Especially, in Japan, the digital modulation method with the transmission efficiency high as a modulation-code-ized method of TC8PSK (Trellis Coded 8 Phase Shift Keying) is adopted by BS digital broadcasting of a broadcast initiation schedule in 2000. Therefore, for example, it will be early influenced [ of C/N ] more by CS digital broadcasting which adopted QPSK (Quadrature Phase Shift Keying) as a modulation-code-ized method of aggravation.

[0005] So, in BS digital broadcasting, the hierarchy modulation technique which hierarchizes and transmits the same contents of information to two kinds of modulation-code-ized methods of the Takashina layer transmission data with the high amount of transmissions and low hierarchy transmission data with the low amount of transmissions as countermeasures of aggravation of C/N by causes, such as weather aggravation, is adopted. In the case of BS digital broadcasting, the transmission data modulated and encoded by TC8PSK are used as the Takashina layer transmission data. Other than this (the transmission data with which BPSK ( $r=1/2$ ) and QPSK ( $r=1/2, 2/3, 3/4, 5/6, 7/8$ ) were modulated and encoded are used as low hierarchy transmission data) It has hierarchized (in addition, as for QPSK, the blowout CHADO coding method is adopted, and, as for  $r$ , the rate of coding is shown.). .

[0006] At BS digital broadcasting, even if it sponsors the same program by adopting such a hierarchy modulation technique, by the Takashina layer transmission data, the dynamic image which the dynamic image and screen size which carried out coma dropping by the low hierarchy image, for example became small by offering a HDTV image, for example, and carried out coma dropping, the static image, the static image which carried out [ voice ] mute are offered. For this reason, in BS digital broadcasting, even if a receive state worsens according to causes, such as weather aggravation, and it becomes impossible to reproduce a HDTV image for example, a viewer can be provided with minimum service of SDTV, a static image, etc.

[0007]

[Problem(s) to be Solved by the Invention] By the way, in the receiving set side of BS digital broadcasting, such the Takashina layer transmission data and low hierarchy transmission data will be switched according to a C/N ratio. For example, a certain fixed threshold will be defined, it will judge whether a C/N ratio is more than this threshold or the following, the Takashina layer and a low hierarchy will be switched, and information will be offered.

[0008] However, the weather is unstable, and when changing the value of a C/N ratio sharply for a short time, or when the C/N ratio has become near the threshold, the hierarchy's of the Takashina layer and a low hierarchy's change-over will arise frequently, for example. In such a case, a change-over with the usual television broadcasting and the television broadcasting to which for example, image contraction was carried out will arise frequently, and the displeasure and the troublesomeness by switch of a screen display will be given to a viewer.

[0009] This invention is made in view of such the actual condition, avoids the troublesomeness of viewing and listening by the hierarchy change-over produced frequently, and aims at offering the receiving set which can view and listen where a viewer is stabilized.

[0010]

[Means for Solving the Problem] The receiving set concerning this invention is transmission data by which digital quadrature modulation was carried out to the predetermined carrier signal. The transmission data which hierarchized the same contents of information to the transmission data (low hierarchy transmission data) of a modulation technique with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency, and a coding method and transmission efficiency, and a coding method, and were transmitted A C/N detection means to be the receiving set to receive and to detect the carrier power pair noise power ratio (C/N ratio) of an input signal, It has a decode means to switch alternatively the Takashina layer transmission data and low hierarchy transmission data from the transmission data to which recovered transmission data from the input signal and it restored according to the above-mentioned C/N ratio, and to decode information. The above-mentioned decode means switches the transmission data decoded when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. When having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, it is characterized by switching the transmission data to decode to the Takashina layer transmission data.

[0011] In this receiving set, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and information is decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0012] Moreover, when the 1st carries out period continuation, the period when the above-mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy transmission data the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above when the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data.

[0013]

[Embodiment of the Invention] As a gestalt of operation of this invention, the receiving set of BS digital broadcasting which applied this invention is explained.

[0014] The block block diagram of the receiving set of BS digital broadcasting of the gestalt of operation of this invention is shown in drawing 1.



[0015] It has the channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, the MPEG decoder 15, a control section 16, and the noise level pair C/N ratio table 17, and the receiving set 1 of BS digital broadcasting is constituted, as shown in drawing 1.

[0016] The RF signal received by the parabolic antenna 2 is inputted into the channel selection section 11. The channel selection section 11 performs magnification, frequency conversion, filtering, etc., and outputs an IF signal. The outputted IF signal is supplied to the recovery section 12.

[0017] To an IF signal, the recovery section 12 performs a digital rectangular cross recovery, a DEPENDANT TEA ring, Viterbi decoding, a day interleave, reverse energy dispersal, RS decode, TS selection processing, etc., and outputs the transport stream (TS) in which the service whose viewer wishes to receive is included. This TS is a multiplexed signal specified with MPEG 2 systems. Moreover, as for this TS, data are packet-ized per 188 bytes of TS packet. TS outputted from the recovery section 12 is supplied to a descrambler 13.

[0018] A descrambler 13 performs descrambling processing to TS currently scrambled using the predetermined code key. TS to which descrambling processing was carried out is supplied to the TS decoder 14.

[0019] The TS decoder 14 performs filtering processing which extracts required TS packet (for example, TS packet for control the information of PSI and SI which are needed for TS packet in which the video information on a program that a viewer wishes to view and listen, audio information, and data information were included, playback of the program, etc. was described to be) with reference to PID (Packet Identification) of supplied TS packet. It separates into video, an audio, and data, respectively, and TS packet in which video information, audio information, and data information are included is supplied to the MPEG decoder 15 as a video elementary stream, an audio elementary stream, and a data elementary stream, respectively. Moreover, TS packet for control is supplied to a control section 16.

[0020] The MPEG decoder 15 performs elongation processing to the video elementary stream by which compression coding is carried out, an audio elementary stream, and a data elementary stream, and outputs the video signal of baseband, an audio signal, and a data signal.

[0021] A control section 16 performs control to the above-mentioned channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, and the MPEG decoder 15. Furthermore, a control section 16 performs switch control with the Takashina layer reception and low hierarchy reception based on the C/N ratio which computed and computed the C/N ratio based on the noise level detected by the recovery section 12.

[0022] The noise level pair C/N ratio table 17 is a table for computing the C/N ratio corresponding to the noise level from the noise level detected by the recovery section 12.

[0023] Next, the internal configuration of the above-mentioned recovery section 12 is explained by using drawing 2.

[0024] As shown in drawing 2, the recovery section 12 The noise level detecting element 21 and the BPSK recovery section 22, The QPSK ( $r=1/2$ ) recovery section 23 and the QPSK ( $r=2/3$ ) recovery section 24, It has the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, the TS8PSK recovery section 28, a multiplexer 29, the switch controller 30, and the transmission-line decode section 31, and is constituted.

[0025] The IF signal outputted from the channel selection section 11 is inputted into the noise level detecting element 21. The noise level detecting element 21 detects the level of the noise contained in the input signal from the inputted IF signal. The information on the detected noise level is supplied to a control section 16. The IF signal after the noise level was detected is supplied to the BPSK recovery section 22, the QPSK ( $r=1/2$ ) recovery section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28.

[0026] Here, in BS digital broadcasting, the modulation technique of BPSK, QPSK, and TC8PSK is switched dynamically, and is broadcast. Moreover, in QPSK, also in it, the rate of coding of a blowout chad sign is switched still more nearly dynamically, and is broadcast. By BS digital

broadcasting, it specifies that signal processing is performed per data configuration called a super frame, and, specifically, eight frames are dividing the super frame further. One frame consists of 48 more slots. At BS digital broadcasting, it is supposed in this slot unit that it is possible to change a modulation-code-ized method. Let this one slot be a data length equivalent to 1TS packet.

[0027] The BPSK recovery section 22, the QPSK ( $r=1/2$ ) recovery section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28 perform blowout tea ring processing, Viterbi decoding processing, etc. to the transmission data of a modulation-code-ized method which corresponded, respectively.

[0028] A multiplexer 29 follows the switch control by the switch controller 30. The recovery output of the BPSK-recovery-section 22, the QPSK ( $r=1/2$ )-recovery-section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28 Dynamically, transmission data are chosen per slot with a switch, and the latter transmission-line decode section 31 is supplied. In addition, while the switch timing of a modulation-code-ized method takes a synchronization in synchronous code added to the so-called head of a super frame and carries out selection detection of the head of a slot, control of a switch location is performed with reference to the information described by TMCC (Transmission and Multiplexing ConfigurationControl).

[0029] The transmission-line decode section 31 performs day interleave processing, reverse energy diffusion process, and RS decode processing to the transmission data to which it restored according to each modulation-code-ized method. Furthermore, in the case of BS digital broadcasting, although transmission of a maximum of eight TS is enabled by one frequency channel, one TS chosen by the viewer etc. is outputted.

[0030] As mentioned above, the recovery section 12 detects the noise level of an input signal in them, and supplies it to them at a control section 16 while it performs transmission-line decode processing in recovery processing of BS digital broadcasting, and a list and reproduces TS in them.

[0031] Next, the internal configuration of the TS decoder 14 is explained by using drawing 3.

[0032] It has the packet filter section 33 and the program selection section 34, and the TS decoder 14 is constituted, as shown in drawing 3.

[0033] PID of TS packet which the TS decoder 14 extracts is specified from a control section 16, and processing which extracts required TS packet is performed with reference to this specified PID.

[0034] PID is the 13-bit information described in TS packet, and is the information for identifying the contents of information included in the TS packet. referring to PID — for example, the packet in which video information is included for the TS packet, the packet in which audio information is included, and the packet in which data information is included — or the TS packet can identify the packet in which PSI (Program Specific Information) and SI (Serves Information) are contained. furthermore, the packet in which the Takashina layer transmission data are contained for that TS packet by this PID — or low hierarchy transmission data are contained — it is discriminable a packet.

[0035] The program selection section 34 extracts only TS packet with which control the packet filter section 33 and specified PID is described to be based on the PID information specified from the control section 16, and supplies it to the MPEG decoder 15. Furthermore, TS packet specified among TS packets which PSI and SI are contained and are is extracted, and a control section 16 is supplied.

[0036] Moreover, PID to which the TS decoder 14 corresponds to the Takashina layer transmission data / low hierarchy transmission data is specified by the control section 16. When PID applicable to the Takashina layer transmission data is specified, the TS decoder 14 extracts TS packet in which the Takashina layer transmission data were contained, and sends out only TS packet by which the Takashina layer transmission data were contained in the latter MPEG decoder 15. Moreover, when PID applicable to low hierarchy transmission data is specified, the

TS decoder 14 extracts TS packet in which low hierarchy transmission data were contained, and sends out only TS packet by which low hierarchy transmission data were contained in the latter MPEG decoder 15. By performing such processing, the Takashina layer transmission data / low hierarchy transmission data can be switched.

[0037] Next, the contents [ data / which are performed by the control section 16 / the Takashina layer transmission data and low hierarchy transmission data ] of control of switch control are explained.

[0038] A control section 16 reads the noise level detected by the recovery section 12, and computes a C/N ratio with reference to the noise level pair C/N ratio table 17 based on the read noise level. On this noise level pair C/N ratio table 17, the correspondence relation between a noise level and a C/N ratio is beforehand described on the table. And a control section 16 switches whether the Takashina layer reception is performed or low hierarchy reception is performed based on the value of this computed C/N ratio.

[0039] Here, by preparing a hysteresis in the switch level of the C/N ratio which computed the switch with the Takashina layer reception and low hierarchy reception, and performing a time limit, in case a condition is switched further, the Takashina layer receive state and a low hierarchy receive state change complicated, and the control section 16 is controlling not to give a viewer displeasure.

[0040] Specifically in this control section 16, the switch level of a C/N ratio is set up as follows.

[0041] (1) Set the switch level of the C/N ratio to the low hierarchy reception from the Takashina layer reception as the 1st level Th 1. For example, if the 1st level was set up with 9dB, when a C/N ratio becomes the midst which is performing the Takashina layer reception with 9dB or less, it is switched to low hierarchy reception from the Takashina layer reception. In addition, this 1st level Th 1 is good to set it as the lowest possible value so that a viewer can be provided as much as possible with the information on the high quality by the Takashina layer transmission data. For example, it is set as C/N ratio extent which a block noise begins to generate.

[0042] (2) Set the switch level of the C/N ratio to the Takashina layer reception from low hierarchy reception as the 2nd level Th 2. Let this 2nd level Th 2 be a value higher than the 1st level Th 1 ( $Th2 > Th1$ ). For example, if the 2nd level was set up with 11dB, when a C/N ratio becomes the midst which is performing low hierarchy reception with 11dB or more, it is switched to the Takashina layer reception from low hierarchy reception. Usually, 2 or 3dB of C/N ratios is easily changed according to a weather condition. Therefore, it is desirable to prepare the margin more than this fluctuation range, and to set up the 2nd level Th 2 from the 1st level Th 1.

[0043] Thus, even when the C/N ratio of an input signal switches and it has become a value near the level by giving a hysteresis to switch level, a complicated screen switch etc. does not occur.

[0044] Furthermore, in this control section 16, the time limit at the time of switching a condition is set up as follows.

[0045] (3) During the 1st period Tm1, when a C/N ratio turns around the 2nd level Th 2 a top continuously, as for the change-over transition to the Takashina layer receive state from a low hierarchy receive state, it performs it. For example, if the 2nd level Th 2 was set up with 11dB and the 1st period Tm1 was set up with 10 seconds, when it changes into the condition that the C/N ratio has exceeded 11dB for 10 seconds or more to the midst which is performing low hierarchy reception, it is switched to the Takashina layer reception from low hierarchy reception.

[0046] (4) During the 2nd period Tm2, when a C/N ratio is continuously less than the 1st level Th 1, as for the change-over transition to a low hierarchy receive state from the Takashina layer receive state, it performs it. Here, the 2nd period Tm2 presupposes that it is a period shorter than the 1st period Tm1 ( $Tm2 \leq Tm1$ ). For example, if the 1st level Th 1 was set up with 9dB and the 2nd period Tm2 was set up with 0.5 seconds, when a C/N ratio changes into the condition that 9dB is in the Mashita time for 0.5 seconds or more at the midst which is performing low hierarchy reception, it is switched to low hierarchy reception from the Takashina layer reception.



[0047] In addition, when priority is given to not showing a viewer the condition that the effect by the block noise appears on a screen, as much as possible and a C/N ratio gets worse, the transition to a low hierarchy receive state from the Takashina layer receive state has set up the time limit short so that it may switch to a low hierarchy receive state immediately. On the contrary, it is made for a hierarchy change-over to also produce \*\*\*\*\*, and the transition to the Takashina layer receive state from a low hierarchy receive state has set up the time limit for a long time, when changing a C/N ratio with the big amplitude for example.

[0048] It explains to the next by showing the State machine which performs state control [ receive state / the Takashina layer receive state and / low hierarchy ] of a switch in drawing 4.

[0049] Control is performed in this State machine according to 4 of a condition S1 – a condition 4 conditions. A condition S1 and a condition S2 are the Takashina layer receive states. PID for extracting the Takashina layer transmission data in a condition S1 and a condition S2 will be supplied to the TS decoder 14 from a control section 16, and a viewer will be provided with the image data of the usual image size. On the other hand, a condition S3 and condition S4 are low hierarchy receive states. A viewer will be provided with the dynamic image which carried out coma dropping, the dynamic image which the screen size became small and carried out coma dropping, a static image, or the static image which carried out [ voice ] mute, although PID for extracting low hierarchy transmission data at the time of a condition S3 and condition S4 is supplied to the TS decoder 14 from a control section 16, for example, the contents of a program are the same as that of the Takashina layer received data.

[0050] First, this receiving set 1 will change in the condition S1, if reset, the reception initiation instruction of powering on or BS digital broadcasting, etc. are given.

[0051] A C/N ratio is judged in this condition S1. When a C/N ratio is larger than the 1st level Th 1, it stops at this condition S1, and when a C/N ratio is the 1st one or less level Th, it changes in the condition S2. Here, a counter timer is started to the timing which changes from a condition S1 to a condition S2.

[0052] In the condition S2, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 2nd period Tm2 and a C/N ratio is the 1st one or less level Th, it stops at this condition S2. Moreover, when [ that the timer value time is smaller than the 2nd period Tm2 and ] a C/N ratio is larger than the 1st level Th 1, it changes in the condition S1. Moreover, when the timer values time are the 2nd two or more periods Tm, it changes in the condition S3. A timer is reset from a condition S2 to the timing which changes from a condition S2 to a condition S1 and a condition S3.

[0053] A C/N ratio is judged in the condition S3. When a C/N ratio is smaller than the 2nd level Th 2, it stops at this condition S3, and when C/N ratios are the 2nd two or more level Th, it changes to condition S4. Here, a timer is started to the timing which changes from a condition S3 to condition S4.

[0054] In condition S4, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 1st period Tm1 and C/N ratios are the 2nd two or more level Th, it stops at this condition S4. Moreover, when [ that the timer value time is smaller than the 1st period Tm1 and ] a C/N ratio is smaller than the 2nd level Th 2, it changes in the condition S3. Moreover, when the timer values time are the 1st one or more periods Tm, it changes in the condition S1. A timer is reset from condition S4 to the timing which changes from condition S4 to a condition S3 and a condition S1.

[0055] He is trying to give a hysteresis to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list as mentioned above with the receiving set 1 of BS digital broadcasting of the gestalt of operation of this invention. Furthermore, even if a C/N ratio switches exceeding a threshold and fills conditions with this receiving set 1, a hierarchy change-over is not performed between fixed time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch. Therefore, a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently, and things are lost. Therefore, giving



a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

[0056] As mentioned above, although the receiving set of BS digital broadcasting was explained as a gestalt of operation of this invention, this invention is not restricted to the receiving set of BS digital broadcasting, and if it is the receiving set of the broadcast which adopted the hierarchy modulation technique, it is applicable [ this invention ] to anythings.

[0057]

[Effect of the Invention] In the receiving set concerning this invention, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and the contents of information are decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0058] moreover, when having decoded low hierarchy transmission data and the above-mentioned C/N ratio continues during the 1st period which became more than the 2nd threshold, the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above which became that the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data. That is, once there is a hierarchy change-over, even if a C/N ratio switches exceeding a threshold and fulfills conditions, a hierarchy change-over is not performed between fixed time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch.

[0059] In the receiving set applied to this invention by this, it is lost that a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently. Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

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**TECHNICAL FIELD**

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[Field of the Invention] This invention relates to the receiving set used for example, for BS digital broadcasting etc.

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PRIOR ART

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[Description of the Prior Art] In recent years, digital broadcasting, such as digital-communication satellite broadcasting service (CS digital broadcasting), digital satellite broadcasting (BS), and land-based digital broadcasting, is proposed as new broadcast media.

[0003] In such digital broadcasting, when a C/N (carrier power / noise power) ratio falls according to causes, such as weather aggravation, the so-called block noise occurs, decode of an image or a sound signal cannot be performed, but the problem that the output of an image or a sound signal gets worse arises.

[0004] Especially, in Japan, the digital modulation method with the transmission efficiency high as a modulation-code-ized method of TC8PSK (Trellis Coded 8 Phase Shift Keying) is adopted by BS digital broadcasting of a broadcast initiation schedule in 2000. Therefore, for example, it will be early influenced [ of C/N ] more by CS digital broadcasting which adopted QPSK (Quadrature Phase Shift Keying) as a modulation-code-ized method of aggravation.

[0005] So, in BS digital broadcasting, the hierarchy modulation technique which hierarchizes and transmits the same contents of information to two kinds of modulation-code-ized methods of the Takashina layer transmission data with the high amount of transmissions and low hierarchy transmission data with the low amount of transmissions as countermeasures of aggravation of C/N by causes, such as weather aggravation, is adopted. In the case of BS digital broadcasting, the transmission data modulated and encoded by TC8PSK are used as the Takashina layer transmission data. Other than this (the transmission data with which BPSK ( $r=1/2$ ) and QPSK ( $r=1/2, 2/3, 3/4, 5/6, 7/8$ ) were modulated and encoded are used as low hierarchy transmission data) It has hierarchized (in addition, as for QPSK, the blowout CHADO coding method is adopted, and, as for  $r$ , the rate of coding is shown.). .

[0006] At BS digital broadcasting, even if it sponsors the same program by adopting such a hierarchy modulation technique, by the Takashina layer transmission data, the dynamic image which the dynamic image and screen size which carried out coma dropping by the low hierarchy image, for example became small by offering a HDTV image, for example, and carried out coma dropping, the static image, the static image which carried out [ voice ] mute are offered. For this reason, in BS digital broadcasting, even if a receive state worsens according to causes, such as weather aggravation, and it becomes impossible to reproduce a HDTV image for example, a viewer can be provided with minimum service of SDTV, a static image, etc.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] In the receiving set concerning this invention, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and the contents of information are decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0058] moreover, when having decoded low hierarchy transmission data and the above-mentioned C/N ratio continues during the 1st period which became more than the 2nd threshold, the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above which became that the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data. That is, once there is a hierarchy change-over, even if a C/N ratio switches exceeding a threshold and fulfills conditions, a hierarchy change-over is not performed between fixed time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch.

[0059] In the receiving set applied to this invention by this, it is lost that a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently. Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

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[Translation done.]

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] By the way, in the receiving set side of BS digital broadcasting, such the Takashina layer transmission data and low hierarchy transmission data will be switched according to a C/N ratio. For example, a certain fixed threshold will be defined, it will judge whether a C/N ratio is more than this threshold or the following, the Takashina layer and a low hierarchy will be switched, and information will be offered.

[0008] However, the weather is unstable, and when changing the value of a C/N ratio sharply for a short time, or when the C/N ratio has become near the threshold, the hierarchy's of the Takashina layer and a low hierarchy's change-over will arise frequently, for example. In such a case, a change-over with the usual television broadcasting and the television broadcasting to which for example, image contraction was carried out will arise frequently, and the displeasure and the troublesomeness by switch of a screen display will be given to a viewer.

[0009] This invention is made in view of such the actual condition, avoids the troublesomeness of viewing and listening by the hierarchy change-over produced frequently, and aims at offering the receiving set which can view and listen where a viewer is stabilized.

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MEANS

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[Means for Solving the Problem] The receiving set concerning this invention is transmission data by which digital quadrature modulation was carried out to the predetermined carrier signal. The transmission data which hierarchized the same contents of information to the transmission data (low hierarchy transmission data) of a modulation technique with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency, and a coding method and transmission efficiency, and a coding method, and were transmitted A C/N detection means to be the receiving set to receive and to detect the carrier power pair noise power ratio (C/N ratio) of an input signal, It has a decode means to switch alternatively the Takashina layer transmission data and low hierarchy transmission data from the transmission data to which recovered transmission data from the input signal and it restored according to the above-mentioned C/N ratio, and to decode information. The above-mentioned decode means switches the transmission data decoded when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold to low hierarchy transmission data. When having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, it is characterized by switching the transmission data to decode to the Takashina layer transmission data.

[0011] In this receiving set, in order to attain resistance to transmission degradation, or differentiation of information quality, for example, the transmission data (low hierarchy transmission data) of a modulation technique and a coding method with low transmission data (Takashina layer transmission data) of a modulation technique with high transmission efficiency and a coding method and transmission efficiency are alternatively switched according to the C/N ratio of an input signal, and information is decoded. Under the present circumstances, a hysteresis is given to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list. With this receiving set, when having decoded the Takashina layer transmission data and a C/N ratio becomes below the 1st threshold, and switching the transmission data to decode to low hierarchy transmission data, having decoded low hierarchy transmission data and it becomes more than the 2nd threshold with the above-mentioned C/N ratio higher than the 1st threshold of the above, specifically, the transmission data to decode are switched to the Takashina layer transmission data.

[0012] Moreover, when the 1st carries out period continuation, the period when the above-mentioned C/N ratio became more than the 2nd threshold when having decoded low hierarchy transmission data the receiving set concerning this invention The transmission data to decode are switched to the Takashina layer transmission data, and when having decoded the Takashina layer transmission data and the 2nd with the period shorter than the 1st period of the above when the C/N ratio became below the 1st threshold carries out period continuation, the transmission data to decode are switched to low hierarchy transmission data.

[0013]

[Embodiment of the Invention] As a gestalt of operation of this invention, the receiving set of BS



digital broadcasting which applied this invention is explained.

[0014] The block block diagram of the receiving set of BS digital broadcasting of the gestalt of operation of this invention is shown in drawing 1.

[0015] It has the channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, the MPEG decoder 15, a control section 16, and the noise level pair C/N ratio table 17, and the receiving set 1 of BS digital broadcasting is constituted, as shown in drawing 1.

[0016] The RF signal received by the parabolic antenna 2 is inputted into the channel selection section 11. The channel selection section 11 performs magnification, frequency conversion, filtering, etc., and outputs an IF signal. The outputted IF signal is supplied to the recovery section 12.

[0017] To an IF signal, the recovery section 12 performs a digital rectangular cross recovery, a DEPENDANT tea ring, Viterbi decoding, a day interleave, reverse energy dispersal, RS decode, TS selection processing, etc., and outputs the transport stream (TS) in which the service whose viewer wishes to receive is included. This TS is a multiplexed signal specified with MPEG 2 systems. Moreover, as for this TS, data are packet-ized per 188 bytes of TS packet. TS outputted from the recovery section 12 is supplied to a descrambler 13.

[0018] A descrambler 13 performs descrambling processing to TS currently scrambled using the predetermined code key. TS to which descrambling processing was carried out is supplied to the TS decoder 14.

[0019] The TS decoder 14 performs filtering processing which extracts required TS packet (for example, TS packet for control the information of PSI and SI which are needed for TS packet in which the video information on a program that a viewer wishes to view and listen, audio information, and data information were included, playback of the program, etc. was described to be) with reference to PID (Packet Identification) of supplied TS packet. It separates into video, an audio, and data, respectively, and TS packet in which video information, audio information, and data information are included is supplied to the MPEG decoder 15 as a video elementary stream, an audio elementary stream, and a data elementary stream, respectively. Moreover, TS packet for control is supplied to a control section 16.

[0020] The MPEG decoder 15 performs elongation processing to the video elementary stream by which compression coding is carried out, an audio elementary stream, and a data elementary stream, and outputs the video signal of baseband, an audio signal, and a data signal.

[0021] A control section 16 performs control to the above-mentioned channel selection section 11, the recovery section 12, a descrambler 13, the TS decoder 14, and the MPEG decoder 15. Furthermore, a control section 16 performs switch control with the Takashina layer reception and low hierarchy reception based on the C/N ratio which computed and computed the C/N ratio based on the noise level detected by the recovery section 12.

[0022] The noise level pair C/N ratio table 17 is a table for computing the C/N ratio corresponding to the noise level from the noise level detected by the recovery section 12.

[0023] Next, the internal configuration of the above-mentioned recovery section 12 is explained by using drawing 2.

[0024] As shown in drawing 2, the recovery section 12 The noise level detecting element 21 and the BPSK recovery section 22, The QPSK ( $r=1/2$ ) recovery section 23 and the QPSK ( $r=2/3$ ) recovery section 24, It has the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, the TS8PSK recovery section 28, a multiplexer 29, the switch controller 30, and the transmission-line decode section 31, and is constituted.

[0025] The IF signal outputted from the channel selection section 11 is inputted into the noise level detecting element 21. The noise level detecting element 21 detects the level of the noise contained in the input signal from the inputted IF signal. The information on the detected noise level is supplied to a control section 16. The IF signal after the noise level was detected is supplied to the BPSK recovery section 22, the QPSK ( $r=1/2$ ) recovery section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28.

[0026] Here, in BS digital broadcasting, the modulation technique of BPSK, QPSK, and TC8PSK is switched dynamically, and is broadcast. Moreover, in QPSK, also in it, the rate of coding of a blowout chad sign is switched still more nearly dynamically, and is broadcast. By BS digital broadcasting, it specifies that signal processing is performed per data configuration called a super frame, and, specifically, eight frames are dividing the super frame further. One frame consists of 48 more slots. At BS digital broadcasting, it is supposed in this slot unit that it is possible to change a modulation-code-ized method. Let this one slot be a data length equivalent to 1TS packet.

[0027] The BPSK recovery section 22, the QPSK ( $r=1/2$ ) recovery section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28 perform blowout tea ring processing, Viterbi decoding processing, etc. to the transmission data of a modulation-code-ized method which corresponded, respectively.

[0028] A multiplexer 29 follows the switch control by the switch controller 30. The recovery output of the BPSK recovery section 22, the QPSK ( $r=1/2$ ) recovery section 23, the QPSK ( $r=2/3$ ) recovery section 24, the QPSK ( $r=3/4$ ) recovery section 25, the QPSK ( $r=5/6$ ) recovery section 26, the QPSK ( $r=7/8$ ) recovery section 27, and the TS8PSK recovery section 28 Dynamically, transmission data are chosen per slot with a switch, and the latter transmission-line decode section 31 is supplied. In addition, while the switch timing of a modulation-code-ized method takes a synchronization in synchronous code added to the so-called head of a super frame and carries out selection detection of the head of a slot, control of a switch location is performed with reference to the information described by TMCC (Transmission and Multiplexing ConfigurationControl).

[0029] The transmission-line decode section 31 performs day interleave processing, reverse energy diffusion process, and RS decode processing to the transmission data to which it restored according to each modulation-code-ized method. Furthermore, in the case of BS digital broadcasting, although transmission of a maximum of eight TS is enabled by one frequency channel, one TS chosen by the viewer etc. is outputted.

[0030] As mentioned above, the recovery section 12 detects the noise level of an input signal in them, and supplies it to them at a control section 16 while it performs transmission-line decode processing in recovery processing of BS digital broadcasting, and a list and reproduces TS in them.

[0031] Next, the internal configuration of the TS decoder 14 is explained by using drawing 3.

[0032] It has the packet filter section 33 and the program selection section 34, and the TS decoder 14 is constituted, as shown in drawing 3.

[0033] PID of TS packet which the TS decoder 14 extracts is specified from a control section 16, and processing which extracts required TS packet is performed with reference to this specified PID.

[0034] PID is the 13-bit information described in TS packet, and is the information for identifying the contents of information included in the TS packet. referring to PID -- for example, the packet in which video information is included for the TS packet, the packet in which audio information is included, and the packet in which data information is included -- or the TS packet can identify the packet in which PSI (Program Specific Information) and SI (Serves Information) are contained. furthermore, the packet in which the Takashina layer transmission data are contained for that TS packet by this PID -- or low hierarchy transmission data are contained -- it is discriminable a packet.

[0035] The program selection section 34 extracts only TS packet with which control the packet filter section 33 and specified PID is described to be based on the PID information specified from the control section 16, and supplies it to the MPEG decoder 15. Furthermore, TS packet specified among TS packets which PSI and SI are contained and are is extracted, and a control section 16 is supplied.

[0036] Moreover, PID to which the TS decoder 14 corresponds to the Takashina layer transmission data / low hierarchy transmission data is specified by the control section 16. When PID applicable to the Takashina layer transmission data is specified, the TS decoder 14 extracts

TS packet in which the Takashina layer transmission data were contained, and sends out only TS packet by which the Takashina layer transmission data were contained in the latter MPEG decoder 15. Moreover, when PID applicable to low hierarchy transmission data is specified, the TS decoder 14 extracts TS packet in which low hierarchy transmission data were contained, and sends out only TS packet by which low hierarchy transmission data were contained in the latter MPEG decoder 15. By performing such processing, the Takashina layer transmission data / low hierarchy transmission data can be switched.

[0037] Next, the contents [ data / which are performed by the control section 16 / the Takashina layer transmission data and low hierarchy transmission data ] of control of switch control are explained.

[0038] A control section 16 reads the noise level detected by the recovery section 12, and computes a C/N ratio with reference to the noise level pair C/N ratio table 17 based on the read noise level. On this noise level pair C/N ratio table 17, the correspondence relation between a noise level and a C/N ratio is beforehand described on the table. And a control section 16 switches whether the Takashina layer reception is performed or low hierarchy reception is performed based on the value of this computed C/N ratio.

[0039] Here, by preparing a hysteresis in the switch level of the C/N ratio which computed the switch with the Takashina layer reception and low hierarchy reception, and performing a time limit, in case a condition is switched further, the Takashina layer receive state and a low hierarchy receive state change complicated, and the control section 16 is controlling not to give a viewer displeasure.

[0040] Specifically in this control section 16, the switch level of a C/N ratio is set up as follows.

[0041] (1) Set the switch level of the C/N ratio to the low hierarchy reception from the Takashina layer reception as the 1st level Th 1. For example, if the 1st level was set up with 9dB, when a C/N ratio becomes the midst which is performing the Takashina layer reception with 9dB or less, it is switched to low hierarchy reception from the Takashina layer reception. In addition, this 1st level Th 1 is good to set it as the lowest possible value so that a viewer can be provided as much as possible with the information on the high quality by the Takashina layer transmission data. For example, it is set as C/N ratio extent which a block noise begins to generate.

[0042] (2) Set the switch level of the C/N ratio to the Takashina layer reception from low hierarchy reception as the 2nd level Th 2. Let this 2nd level Th 2 be a value higher than the 1st level Th 1 ( $Th2 > Th1$ ). For example, if the 2nd level was set up with 11dB, when a C/N ratio becomes the midst which is performing low hierarchy reception with 11dB or more, it is switched to the Takashina layer reception from low hierarchy reception. Usually, 2 or 3dB of C/N ratios is easily changed according to a weather condition. Therefore, it is desirable to prepare the margin more than this fluctuation range, and to set up the 2nd level Th 2 from the 1st level Th 1.

[0043] Thus, even when the C/N ratio of an input signal switches and it has become a value near the level by giving a hysteresis to switch level, a complicated screen switch etc. does not occur.

[0044] Furthermore, in this control section 16, the time limit at the time of switching a condition is set up as follows.

[0045] (3) During the 1st period Tm1, when a C/N ratio turns around the 2nd level Th 2 a top continuously, as for the change-over transition to the Takashina layer receive state from a low hierarchy receive state, it performs it. For example, if the 2nd level Th 2 was set up with 11dB and the 1st period Tm1 was set up with 10 seconds, when it changes into the condition that the C/N ratio has exceeded 11dB for 10 seconds or more to the midst which is performing low hierarchy reception, it is switched to the Takashina layer reception from low hierarchy reception.

[0046] (4) During the 2nd period Tm2, when a C/N ratio is continuously less than the 1st level Th 1, as for the change-over transition to a low hierarchy receive state from the Takashina layer receive state, it performs it. Here, the 2nd period Tm2 presupposes that it is a period shorter than the 1st period Tm1 ( $Tm2 \leq Tm1$ ). For example, if the 1st level Th 1 was set up with 9dB and the 2nd period Tm2 was set up with 0.5 seconds, when a C/N ratio changes into the



condition that 9dB is in the Mashita time for 0.5 seconds or more at the midst which is performing low hierarchy reception, it is switched to low hierarchy reception from the Takashina layer reception.

[0047] In addition, when priority is given to not showing a viewer the condition that the effect by the block noise appears on a screen, as much as possible and a C/N ratio gets worse, the transition to a low hierarchy receive state from the Takashina layer receive state has set up the time limit short so that it may switch to a low hierarchy receive state immediately. On the contrary, it is made for a hierarchy change-over to also produce \*\*\*\*\*, and the transition to the Takashina layer receive state from a low hierarchy receive state has set up the time limit for a long time, when changing a C/N ratio with the big amplitude for example.

[0048] It explains to the next by showing the State machine which performs state control [receive-state / the Takashina-layer receive state and-/ low hierarchy-] of a switch in drawing 4.

[0049] Control is performed in this State machine according to 4 of a condition S1 - a condition 4 conditions. A condition S1 and a condition S2 are the Takashina layer receive states. PID for extracting the Takashina layer transmission data in a condition S1 and a condition S2 will be supplied to the TS decoder 14 from a control section 16, and a viewer will be provided with the image data of the usual image size. On the other hand, a condition S3 and condition S4 are low hierarchy receive states. A viewer will be provided with the dynamic image which carried out coma dropping, the dynamic image which the screen size became small and carried out coma dropping, a static image, or the static image which carried out [ voice ] mute, although PID for extracting low hierarchy transmission data at the time of a condition S3 and condition S4 is supplied to the TS decoder 14 from a control section 16, for example, the contents of a program are the same as that of the Takashina layer received data.

[0050] First, this receiving set 1 will change in the condition S1, if reset, the reception initiation instruction of powering on or BS digital broadcasting, etc. are given.

[0051] A C/N ratio is judged in this condition S1. When a C/N ratio is larger than the 1st level Th 1, it stops at this condition S1, and when a C/N ratio is the 1st one or less level Th, it changes in the condition S2. Here, a counter timer is started to the timing which changes from a condition S1 to a condition S2.

[0052] In the condition S2, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 2nd period Tm2 and a C/N ratio is the 1st one or less level Th, it stops at this condition S2. Moreover, when [ that the timer value time is smaller than the 2nd period Tm2 and ] a C/N ratio is larger than the 1st level Th 1, it changes in the condition S1. Moreover, when the timer values time are the 2nd two or more periods Tm, it changes in the condition S3. A timer is reset from a condition S2 to the timing which changes from a condition S2 to a condition S1 and a condition S3.

[0053] A C/N ratio is judged in the condition S3. When a C/N ratio is smaller than the 2nd level Th 2, it stops at this condition S3, and when C/N ratios are the 2nd two or more level Th, it changes to condition S4. Here, a timer is started to the timing which changes from a condition S3 to condition S4.

[0054] In condition S4, the timer value time counted by the timer with the C/N ratio is judged. When the timer value time is smaller than the 1st period Tm1 and C/N ratios are the 2nd two or more level Th, it stops at this condition S4. Moreover, when [ that the timer value time is smaller than the 1st period Tm1 and ] a C/N ratio is smaller than the 2nd level Th 2, it changes in the condition S3. Moreover, when the timer values time are the 1st one or more periods Tm, it changes in the condition S1. A timer is reset from condition S4 to the timing which changes from condition S4 to a condition S3 and a condition S1.

[0055] He is trying to give a hysteresis to the threshold of the C/N ratio which sets the timing of the switch from low hierarchy transmission data to the Takashina layer transmission data to the switch to low hierarchy transmission data from the Takashina layer transmission data, and a list as mentioned above with the receiving set 1 of BS digital broadcasting of the gestalt of operation of this invention. Furthermore, even if a C/N ratio switches exceeding a threshold and fills conditions with this receiving set 1, a hierarchy change-over is not performed between fixed

time amount, but after it is judged that the C/N ratio exceeded the threshold certainly, it will be made to perform a hierarchy switch. Therefore, a switch with the Takashina layer transmission data and low hierarchy transmission data arises frequently, and things are lost. Therefore, giving a viewer the displeasure and the troublesomeness by switch of a screen display is lost, and where a viewer is stabilized, it can view and listen.

[0056] As mentioned above, although the receiving set of BS digital broadcasting was explained as a gestalt of operation of this invention, this invention is not restricted to the receiving set of BS digital broadcasting, and if it is the receiving set of the broadcast which adopted the hierarchy modulation technique, it is applicable [ this invention ] to anythings.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is the block block diagram of the receiving set of BS digital broadcasting which applied this invention.

[Drawing 2] It is the block block diagram of the recovery section of the above-mentioned receiving set.

[Drawing 3] It is the block block diagram of TS decoder of the above-mentioned receiving set.

[Drawing 4] It is drawing showing the State machine which performs state control [ receive state / the Takashina layer receive state and / low hierarchy ] of a switch.

[Description of Notations]

1 BS Digital-Broadcasting Receiving Set, 2 Parabolic Antenna, 11 Channel Selection Section, 12 Recovery Sections, 13 Descrambler, 14 TS Decoder, 15 MPEG Decoder, 16 Control Section, 17 Noise Level Pair C/N Ratio Table, 21 Noise Level Detecting Element

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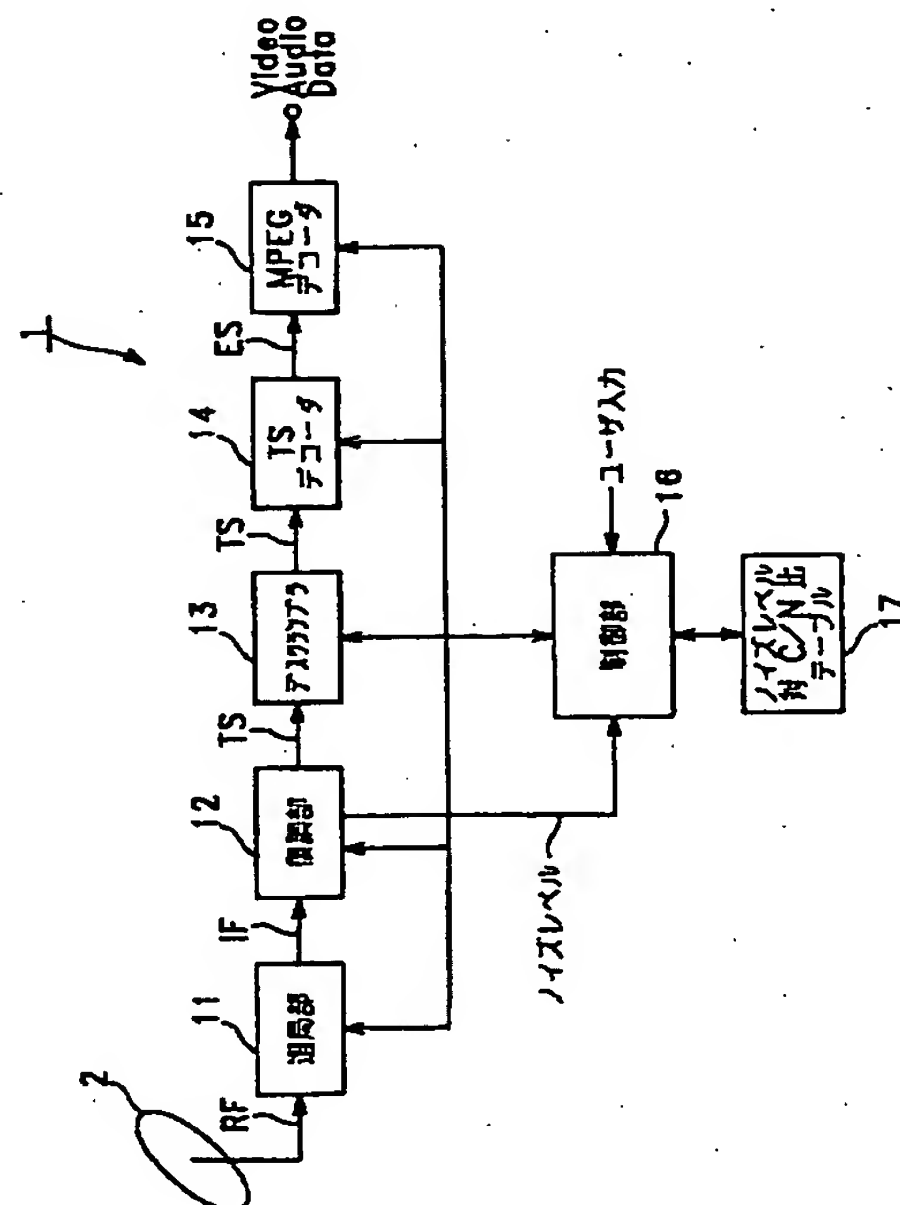
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(54) 【発明の名称】 受信装置

(57) 【要約】

【課題】 BSデジタル放送で採用される階層変調方式を切り換える際に、頻繁に生じる階層切換による視聴の煩わしさを回避する。

【解決手段】 本発明のBSデジタル放送の受信装置1では、高階層伝送データと低階層伝送データとを、受信信号のC/N比に応じて選択的に切り換えて、情報内容の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換のタイミングを定めるC/N比のしきい値に、ヒステリシスを持たせる。



## 【特許請求の範囲】

【請求項1】 所定の搬送波信号に対してデジタル直交変調された伝送データであって、同一の情報内容を伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とに階層化して伝送された伝送データを、受信する受信装置において、受信信号の搬送波電力対ノイズ電力比（C/N比）を検出するC/N検出手段と、

受信信号から伝送データを復調し、上記C/N比に応じて復調された伝送データから高階層伝送データと低階層伝送データとを選択的に切り換えて情報の復号をする復号手段とを備え、

上記復号手段は、高階層伝送データを復号している際にC/N比が第1のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記C/N比が上記第1のしきい値より高い第2のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えることを特徴とする受信装置。

【請求項2】 上記復号手段は、低階層伝送データを復号している際に上記C/N比が第2のしきい値以上となった期間が所定時間連続したときに、復号する伝送データを高階層伝送データに切り換えることを特徴とする請求項1記載の受信装置。

【請求項3】 上記復号手段は、高階層伝送データを復号している際にC/N比が第1のしきい値以下となった期間が所定時間連続したときに、復号する伝送データを低階層伝送データに切り換えることを特徴とする請求項1記載の受信装置。

【請求項4】 上記復号手段は、低階層伝送データを復号している際に上記C/N比が第2のしきい値以上となった期間が第1の期間連続したときに、復号する伝送データを高階層伝送データに切り換え、高階層伝送データを復号している際にC/N比が第1のしきい値以下となった期間が上記第1の期間より短い第2の期間連続したときには復号する伝送データを低階層伝送データに切り換えることを特徴とする請求項1記載の受信装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、例えばBSデジタル放送等に用いられる受信装置に関するものである。

【0002】

【従来の技術】 近年、デジタル通信衛星放送（CSデジタル放送）、デジタル衛星放送（BS）、デジタル地上波放送等のデジタル放送が新たな放送メディアとして提案されている。

【0003】 このようなデジタル放送では、天候悪化などの原因によりC/N（搬送波電力/雑音電力）比が下

がった場合、いわゆるブロックノイズが発生し、そのため画像や音声信号の復号ができず、画像や音声信号の出力が悪化するという問題が生じる。

【0004】 特に、2000年に日本において放送開始予定のBSデジタル放送では、変調符号化方式としてTC8PSK（Trellis Coded 8 Phase Shift Keying）とといった伝送効率の高いデジタル変調方式を採用している。そのため、例えば、変調符号化方式としてQPSK（Quadrature Phase Shift Keying）を採用したCSデジタル放送等よりも、C/Nの悪化の影響をより早く受けることになってしまう。

【0005】 そこで、BSデジタル放送では、天候悪化等の原因によるC/Nの悪化の対応策として、同一の情報内容を、伝送量が高い高階層伝送データと、伝送量が低い低階層伝送データとの2通りの変調符号化方式に階層化して伝送する階層変調方式が採用されている。BSデジタル放送の場合、TC8PSKで変調及び符号化された伝送データを高階層伝送データとし、それ以外（BPSK（ $r=1/2$ ）、QPSK（ $r=1/2, 2/3, 3/4, 5/6, 7/8$ ）の変調及び符号化された伝送データを低階層伝送データとして、階層化している（なお、QPSKは、バンクチャード符号化方式が採用されており、 $r$ はその符号化率を示している。）。

【0006】 BSデジタル放送では、このような階層変調方式を採用することにより、同じ番組を提供していても、高階層伝送データでは、例えばHDTV画像を提供し、低階層画像では、例えばコマ落としをした動画像、画面サイズが小さくなり且つコマ落としをした動画像、静止画像、音声ミュートした静止画像等を提供している。このため、BSデジタル放送では、例えば、天候悪化等の原因により受信状態が悪くなり、HDTV画像を再生することができなくなったとしても、SDTVや静止画像等の最低限のサービスを視聴者に提供することができる。

【0007】

【発明が解決しようとする課題】 ところで、BSデジタル放送の受信装置側では、このような高階層伝送データと低階層伝送データとを、C/N比に応じて切り換えることとなる。例えば、ある一定のしきい値を定め、C/N比がこのしきい値以上或いは以下であるかを判断し、高階層と低階層とを切り換えて情報を提供することとなる。

【0008】 しかしながら、例えば天候が不安定でC/N比の値が短時間で大幅に変動する場合、或いは、C/N比がしきい値近傍となっている場合には、高階層と低階層との階層の切替が頻繁に生じてしまう。このような場合、通常のテレビジョン放送と、例えば画像縮小がされたテレビジョン放送との切替が頻繁に生じてしまい、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えてしまう。

【0009】本発明は、このような実情を鑑みてなされたものであり、頻繁に生じる階層切換による視聴の煩わしさを回避し、視聴者が安定した状態で視聴を行うことができる受信装置を提供することを目的とする。

【0010】

【課題を解決するための手段】本発明にかかる受信装置は、所定の搬送波信号に対してデジタル直交変調された伝送データであって、同一の情報内容を伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とに階層化して伝送された伝送データを、受信する受信装置であって、受信信号の搬送波電力対ノイズ電力比（C/N比）を検出するC/N比検出手段と、受信信号から伝送データを復調し、上記C/N比に応じて復調された伝送データから高階層伝送データと低階層伝送データとを選択的に切り換えて情報の復号をする復号手段とを備え、上記復号手段は、高階層伝送データを復号している際にC/N比が第1のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記C/N比が上記第1のしきい値より高い第2のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えることを特徴とする。

【0011】この受信装置では、例えば伝送劣化への耐性或いは情報品質の差別化等を図るため、伝送効率の高い変調方式及び符号化方式の伝送データ（高階層伝送データ）と伝送効率の低い変調方式及び符号化方式の伝送データ（低階層伝送データ）とを、受信信号のC/N比に応じて選択的に切り換えて、情報の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えのタイミングを定めるC/N比のしきい値に、ヒステリシスを持たせるようにする。具体的には、この受信装置では、高階層伝送データを復号している際にC/N比が第1のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記C/N比が上記第1のしきい値より高い第2のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えるようにする。

【0012】また、本発明にかかる受信装置は、低階層伝送データを復号している際に上記C/N比が第2のしきい値以上となった期間が第1の期間連続したときに、復号する伝送データを高階層伝送データに切り換え、高階層伝送データを復号している際にC/N比が第1のしきい値以下となった期間が上記第1の期間より短い第2の期間連続したときには復号する伝送データを低階層伝送データに切り換える。

【0013】

【発明の実施の形態】本発明の実施の形態として、本発

明を適用したBSデジタル放送の受信装置について説明をする。

【0014】図1に、本発明の実施の形態のBSデジタル放送の受信装置のブロック構成図を示す。

【0015】BSデジタル放送の受信装置1は、図1に示すように、選局部11と、復調部12と、デスクランブラ13と、TSデコーダ14と、MPEGデコーダ15と、制御部16と、ノイズレベル対C/N比テーブル17とを備えて構成される。

【0016】選局部11には、パラボラアンテナ2により受信されたRF信号が入力される。選局部11は、増幅、周波数変換、フィルタリング等を行い、IF信号を出力する。出力されたIF信号は、復調部12に供給される。

【0017】復調部12は、IF信号に対して、デジタル直交復調、デバנקチャリング、ピタビ復号、デインタリーブ、逆エネルギー拡散、RS復号、TS選択処理等を行い、視聴者が受信を希望するサービスが含まれているトランスポートストリーム（TS）を出力する。このTSは、MPEG2システムズにより規定されている多重化信号である。また、このTSは、188バイトのTSパケット単位でデータがパケット化されている。復調部12から出力されたTSは、デスクランブラ13に供給される。

【0018】デスクランブラ13は、所定の暗号キーを用いてスクランブルされているTSに対して、デスクランブル処理を行う。デスクランブル処理がされたTSは、TSデコーダ14に供給される。

【0019】TSデコーダ14は、供給されてきたTSパケットのPID（Packet Identification）を参照して、必要なTSパケット（例えば視聴者が視聴を希望するプログラムのビデオ情報、オーディオ情報、データ情報が含まれたTSパケットや、そのプログラムの再生等に必要となるPSIやSIといった情報が記述された制御用のTSパケット）を抽出するフィルタリング処理を行う。ビデオ情報、オーディオ情報、データ情報が含まれているTSパケットは、ビデオ、オーディオ、データにそれぞれ分離され、ビデオエレメンタリストリーム、オーディオエレメンタリストリーム、データエレメンタリストリームとして、それぞれMPEGデコーダ15に供給される。また、制御用のTSパケットは、制御部16に供給される。

【0020】MPEGデコーダ15は、圧縮符号化されているビデオエレメンタリストリーム、オーディオエレメンタリストリーム、データエレメンタリストリームに対する伸張処理を行い、ベースバンドのビデオ信号、オーディオ信号、データ信号を出力する。

【0021】制御部16は、上記選局部11、復調部12、デスクランブラ13、TSデコーダ14、MPEGデコーダ15に対する制御を行う。さらに、制御部16



は、復調部12により検出されたノイズレベルに基づきC/N比を算出し、算出したC/N比に基づき高階層受信と低階層受信との切り換え制御を行う。

【0022】ノイズレベル対C/N比テーブル17は、復調部12により検出されたノイズレベルから、そのノイズレベルに対応したC/N比を算出するためのテーブルである。

【0023】つぎに、上記復調部12の内部構成について図2を用いて説明をする。

【0024】復調部12は、図2に示すように、ノイズレベル検出部21と、BPSK復調部22と、QPSK (r=1/2) 復調部23と、QPSK (r=2/3) 復調部24と、QPSK (r=3/4) 復調部25と、QPSK (r=5/6) 復調部26と、QPSK (r=7/8) 復調部27と、TS8PSK復調部28と、マルチプレクサ29と、切り換えコントローラ30と、伝送路復号部31とを備えて構成される。

【0025】ノイズレベル検出部21には、選局部11から出力されるIF信号が入力される。ノイズレベル検出部21は、入力されたIF信号から受信信号に含まれているノイズのレベルを検出する。検出されたノイズレベルの情報は、制御部16に供給される。ノイズレベルが検出された後のIF信号は、BPSK復調部22、QPSK (r=1/2) 復調部23、QPSK (r=2/3) 復調部24、QPSK (r=3/4) 復調部25、QPSK (r=5/6) 復調部26、QPSK (r=7/8) 復調部27、TS8PSK復調部28に供給される。

【0026】ここで、BSデジタル放送では、BPSK、QPSK、TC8PSKの変調方式が、動的に切り換えられて放送される。また、QPSKでは、その中でもバンクチャド符号の符号化率がさらに動的に切り換えられて放送される。具体的には、BSデジタル放送では、スーパーフレームと呼ばれるデータ構成単位で信号処理が行われることを規定し、さらに、そのスーパーフレームを8個のフレームで分割している。1フレームは、さらに48個のスロットで構成されている。BSデジタル放送では、このスロット単位で、変調符号化方式を変更することが可能とされている。この1スロットは、1TSパケットに相当するデータ長とされている。

【0027】BPSK復調部22、QPSK (r=1/2) 復調部23、QPSK (r=2/3) 復調部24、QPSK (r=3/4) 復調部25、QPSK (r=5/6) 復調部26、QPSK (r=7/8) 復調部27、TS8PSK復調部28は、それぞれ対応した変調符号化方式の伝送データに対するバンクチャリング処理、ピタビ復号処理等を行う。

【0028】マルチプレクサ29は、切り換えコントローラ30による切り換え制御に従い、BPSK復調部22、QPSK (r=1/2) 復調部23、QPSK (r=2/3) 復調部24、QPSK (r=3/4) 復調部25、QPSK

(r=5/6) 復調部26、QPSK (r=7/8) 復調部27、TS8PSK復調部28の復調出力を動的に切り換えながら伝送データを、スロット単位で選択して、後段の伝送路復号部31に供給する。なお、変調符号化方式の切り換えタイミングは、いわゆるスーパーフレームの先頭に付加されている同期コードにより同期をとってスロットの先頭を選択検出するとともに、TMCC (Transmission and Multiplexing Configuration Control) に記述されている情報を参照して、切り換え位置の制御が行われる。

【0029】伝送路復号部31は、各変調符号化方式に応じて復調された伝送データに対して、デインタリーブ処理、逆エネルギー拡散処理、RS復号処理を行う。さらに、BSデジタル放送の場合には、1つの周波数チャンネルで最大8本のTSを伝送可能とされているが、そのうち、視聴者等により選択された1つのTSを出力する。

【0030】以上のように復調部12は、BSデジタル放送の復調処理、並びに、伝送路復号処理を行い、TSを再生するとともに、受信信号のノイズレベルを検出して制御部16に供給する。

【0031】つぎに、TSデコーダ14の内部構成について図3を用いて説明をする。

【0032】TSデコーダ14は、図3に示すように、パケットフィルタ部33と、プログラム選択部34とを備えて構成される。

【0033】TSデコーダ14は、抽出するTSパケットのPIDが、制御部16から指定され、この指定されたPIDを参照して、必要なTSパケットを抽出する処理を行う。

【0034】PIDは、TSパケット内に記述された13ビットの情報で、そのTSパケットに含まれている情報内容を識別するための情報である。PIDを参照することによって、例えば、そのTSパケットがビデオ情報が含まれているパケットか、オーディオ情報が含まれているパケットか、データ情報が含まれているパケットか、或いは、そのTSパケットがPSI (Program Specific Information) やSI (Service Information) が含まれているパケットか、といったことを識別することができる。また、さらに、このPIDにより、そのTSパケットが、高階層伝送データが含まれているパケットか、或いは、低階層伝送データが含まれているパケットかも識別することができる。

【0035】プログラム選択部34は、制御部16から指定されたPID情報に基づき、パケットフィルタ部33を制御して、指定されたPIDが記述されているTSパケットのみを抽出してMPEGデコーダ15に供給する。また、さらに、PSIやSIが含まれているTSパケットのうち、指定されたTSパケットを抽出して制御部16に供給する。



【0036】また、TSデコーダ14は、高階層伝送データ/低階層伝送データに該当するPIDが、制御部16により指定される。TSデコーダ14は、高階層伝送データに該当するPIDが指定された場合には、高階層伝送データが含まれたTSパケットを抽出して、後段のMPEGデコーダ15に高階層伝送データが含まれたTSパケットのみを送出する。また、TSデコーダ14は、低階層伝送データに該当するPIDが指定された場合には、低階層伝送データが含まれたTSパケットを抽出して、後段のMPEGデコーダ15に低階層伝送データが含まれたTSパケットのみを送出する。このような処理を行うことにより、高階層伝送データ/低階層伝送データの切り換えを行うことができる。

【0037】つぎに、制御部16により行われる高階層伝送データと低階層伝送データとの切り換え制御の制御内容について説明をする。

【0038】制御部16は、復調部12により検出されたノイズレベルを読み出し、読み出したノイズレベルに基づきノイズレベル対C/N比テーブル17を参照し、C/N比を算出する。このノイズレベル対C/N比テーブル17には、予めノイズレベルとC/N比との対応関係をテーブル上に記述してある。そして、制御部16は、この算出したC/N比の値に基づき、高階層受信を行うか、低階層受信を行うかの切り換えを行う。

【0039】ここで、制御部16は、高階層受信と低階層受信との切り換えを、算出したC/N比の切り換えレベルにヒステリシスを設け、さらに、状態を切り換える際に時間制限を行うことにより、高階層受信状態と低階層受信状態とが煩雑に切り替わり、視聴者に不快感を与えないように制御をしている。

【0040】この制御部16では、具体的には、C/N比の切り換えレベルを以下のように設定をしている。

【0041】(1) 高階層受信から低階層受信へのC/N比の切り換えレベルを、第1のレベルTh1に設定する。例えば、第1のレベルを9dBと設定したとすれば、高階層受信を行っている最中にC/N比が9dB以下となったときには、高階層受信から低階層受信へ切り換えられる。なお、この第1のレベルTh1は、できるだけ高階層伝送データによる高品質の情報を視聴者に提供できるように、可能な限り低い値に設定するとよい。例えば、ブロックノイズが発生し始めるC/N比程度に設定をする。

【0042】(2) 低階層受信から高階層受信へのC/N比の切り換えレベルを、第2のレベルTh2に設定する。この第2のレベルTh2は、第1のレベルTh1よりも高い値とする( $Th2 > Th1$ )。例えば、第2のレベルを11dBと設定したとすれば、低階層受信を行っている最中にC/N比が11dB以上となったときには、低階層受信から高階層受信へ切り換えられる。通常、C/N比は、天候状態によって2、3dBは容易に

変動する。そのため、第1のレベルTh1から、この変動範囲以上のマージンを設けて、第2のレベルTh2を設定することが望ましい。

【0043】このように切り換えレベルにヒステリシスを持たせることにより、例えば、受信信号のC/N比が切り換えレベルの近傍の値となっている場合でも、煩雑な画面切り換え等が発生しない。

【0044】また、さらに、この制御部16では、状態を切り換える際の時間制限を以下のように設定をしている。

【0045】(3) 低階層受信状態から高階層受信状態への切換遷移は、C/N比が第2のレベルTh2を、第1の期間Tm1の間、連続して上まわったときに行う。例えば、第2のレベルTh2を11dBと設定し、第1の期間Tm1を10秒と設定したとすれば、低階層受信を行っている最中にC/N比が11dBを10秒以上の間上回っている状態となったときには、低階層受信から高階層受信へ切り換えられる。

【0046】(4) 高階層受信状態から低階層受信状態への切換遷移は、C/N比が第1のレベルTh1を、第2の期間Tm2の間、連続して下回ったときに行う。ここで、第2の期間Tm2は、第1の期間Tm1より短い期間であるとする( $Tm2 \leq Tm1$ )。例えば、第1のレベルTh1を9dBと設定し、第2の期間Tm2を0.5秒と設定したとすれば、低階層受信を行っている最中にC/N比が9dBを0.5秒以上の間下回っている状態となったときには、高階層受信から低階層受信へ切り換えられる。

【0047】なお、高階層受信状態から低階層受信状態への遷移は、ブロックノイズによる影響が画面に現れる状態をできるだけ視聴者に見せないことを優先して、C/N比が悪化した場合には、即座に低階層受信状態に切り換えるように、時間制限を短く設定している。反対に、低階層受信状態から高階層受信状態への遷移は、例えば、大きな振幅でC/N比が変動する場合などになんども階層切換が生じないようにし、時間制限を長く設定している。

【0048】つぎに、高階層受信状態と低階層受信状態との切り換えの状態制御を行うステートマシンの図4に示して説明を行う。

【0049】このステートマシンには、状態S1～状態4の4状態により制御が行われる。状態S1と状態S2は、高階層受信状態である。状態S1及び状態S2のときには、高階層伝送データを抽出するためのPIDが制御部16からTSデコーダ14に供給され、通常の画像サイズの画像データが視聴者に提供されることとなる。一方、状態S3と状態S4は、低階層受信状態である。状態S3及び状態S4のときには、低階層伝送データを抽出するためのPIDが制御部16からTSデコーダ14に供給され、例えば、番組内容は高階層受信デー

タと同一であるが、コマ落としをした動画像、画面サイズが小さくなり且つコマ落としをした動画像、静止画像、或いは、音声をミュートした静止画像等が視聴者に提供されることとなる。

【0050】まず、この受信装置1がリセットや電源投入、或いは、BSデジタル放送の受信開始命令等が与えられると、状態S1に遷移する。

【0051】この状態S1では、C/N比が判断される。C/N比が第1のレベル $Th_1$ より大きい場合には、この状態S1で留まり、C/N比が第1のレベル $Th_1$ 以下である場合には、状態S2に遷移する。ここで、状態S1から状態S2へ遷移するタイミングで、カウンタタイマーが起動される。

【0052】状態S2では、C/N比とともにタイマーによりカウントされたタイマー値 $time$ が判断される。タイマー値 $time$ が第2の期間 $Tm_2$ より小さく且つC/N比が第1のレベル $Th_1$ 以下である場合には、この状態S2で留まる。また、タイマー値 $time$ が第2の期間 $Tm_2$ より小さく且つC/N比が第1のレベル $Th_1$ より大きい場合には、状態S1に遷移する。また、タイマー値 $time$ が第2の期間 $Tm_2$ 以上の場合には、状態S3に遷移する。状態S2から状態S1、状態S2から状態S3へ遷移するタイミングで、タイマーがリセットされる。

【0053】状態S3では、C/N比が判断される。C/N比が第2のレベル $Th_2$ より小さい場合には、この状態S3で留まり、C/N比が第2のレベル $Th_2$ 以上である場合には、状態S4に遷移する。ここで、状態S3から状態S4へ遷移するタイミングで、タイマーが起動される。

【0054】状態S4では、C/N比とともにタイマーによりカウントされたタイマー値 $time$ が判断される。タイマー値 $time$ が第1の期間 $Tm_1$ より小さく且つC/N比が第2のレベル $Th_2$ 以上である場合には、この状態S4で留まる。また、タイマー値 $time$ が第1の期間 $Tm_1$ より小さく且つC/N比が第2のレベル $Th_2$ より小さい場合には、状態S3に遷移する。また、タイマー値 $time$ が第1の期間 $Tm_1$ 以上の場合には、状態S1に遷移する。状態S4から状態S3、状態S4から状態S1へ遷移するタイミングで、タイマーがリセットされる。

【0055】以上のように本発明の実施の形態のBSデジタル放送の受信装置1では、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えるタイミングを定めるC/N比のしきい値に、ヒステリシスを持たせるようにしている。さらに、この受信装置1では、たとえC/N比がしきい値を越えて切り換え条件を満たしたとしても、一定時間の間は階層切換を行わず、確実にC/N比がしきい値を越えたと判断されてから階層切り換えを

行うようにしている。そのため、高階層伝送データと低階層伝送データとの切り換えが頻繁に生じることがなくなる。従って、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えることがなくなり、視聴者が安定した状態で視聴を行うことができる。

【0056】以上、本発明の実施の形態としてBSデジタル放送の受信装置について説明をしたが、本発明は、BSデジタル放送の受信装置に限られるものではなく、階層変調方式を採用した放送の受信装置であればどのようなものにも適用することができる。

【0057】

【発明の効果】本発明にかかる受信装置では、例えば伝送劣化への耐性或いは情報品質の差別化等を図るため、伝送効率の高い変調方式及び符号化方式の伝送データ

(高階層伝送データ)と伝送効率の低い変調方式及び符号化方式の伝送データ(低階層伝送データ)とを、受信信号のC/N比に応じて選択的に切り換えて、情報内容の復号を行う。この際、高階層伝送データから低階層伝送データへの切り換え、並びに、低階層伝送データから高階層伝送データへの切り換えるタイミングを定めるC/N比のしきい値に、ヒステリシスを持たせるようにする。具体的には、この受信装置では、高階層伝送データを復号している際にC/N比が第1のしきい値以下となったときには復号する伝送データを低階層伝送データに切り換え、低階層伝送データを復号している際に上記C/N比が上記第1のしきい値より高い第2のしきい値以上となったときには復号する伝送データを高階層伝送データに切り換えるようにする。

【0058】また、本発明にかかる受信装置は、低階層伝送データを復号している際に上記C/N比が第2のしきい値以上となった第1の期間の間連続したときには、復号する伝送データを高階層伝送データに切り換え、高階層伝送データを復号している際にC/N比が第1のしきい値以下となったとなった期間が上記第1の期間より短い第2の期間連続したときには復号する伝送データを低階層伝送データに切り換える。すなわち、一旦階層切換があったのちには、たとえC/N比がしきい値を越えて切り換え条件を満たしたとしても、一定時間の間は階層切換を行わず、確実にC/N比がしきい値を越えたと判断されてから階層切り換えを行うようにする。

【0059】このことにより本発明にかかる受信装置では、高階層伝送データと低階層伝送データとの切り換えが頻繁に生じることがなくなる。従って、視聴者に例えば画面表示の切り換えによる不快感や煩わしさを与えることがなくなり、視聴者が安定した状態で視聴を行うことができる。

【図面の簡単な説明】

【図1】本発明を適用したBSデジタル放送の受信装置のブロック構成図である。

【図2】上記受信装置の復調部のブロック構成図であ

る。

【図3】上記受信装置のTSデコーダのブロック構成図である。

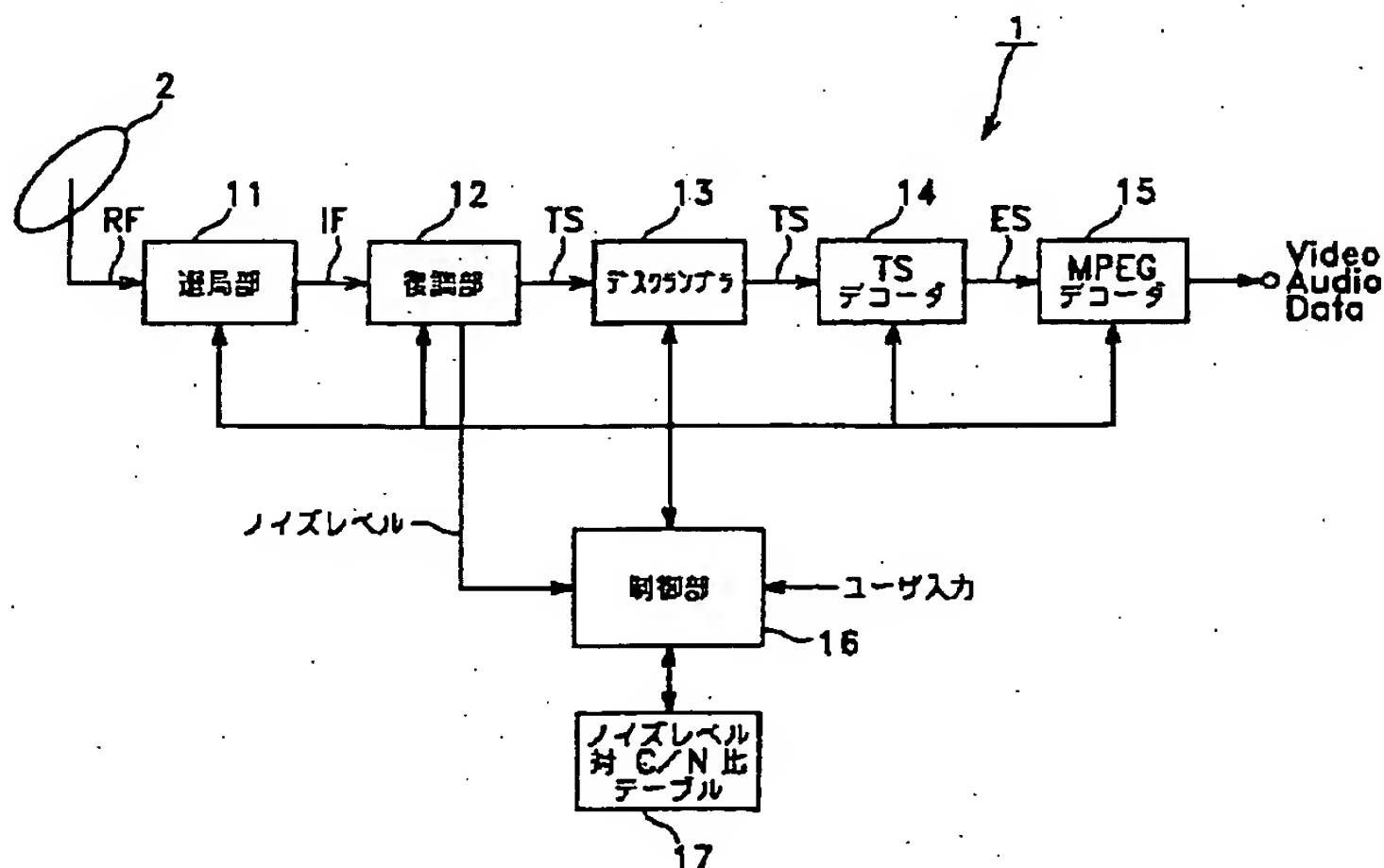
【図4】高階層受信状態と低階層受信状態との切り換えの状態制御を行うステートマシーンを示す図である。

【符号の説明】

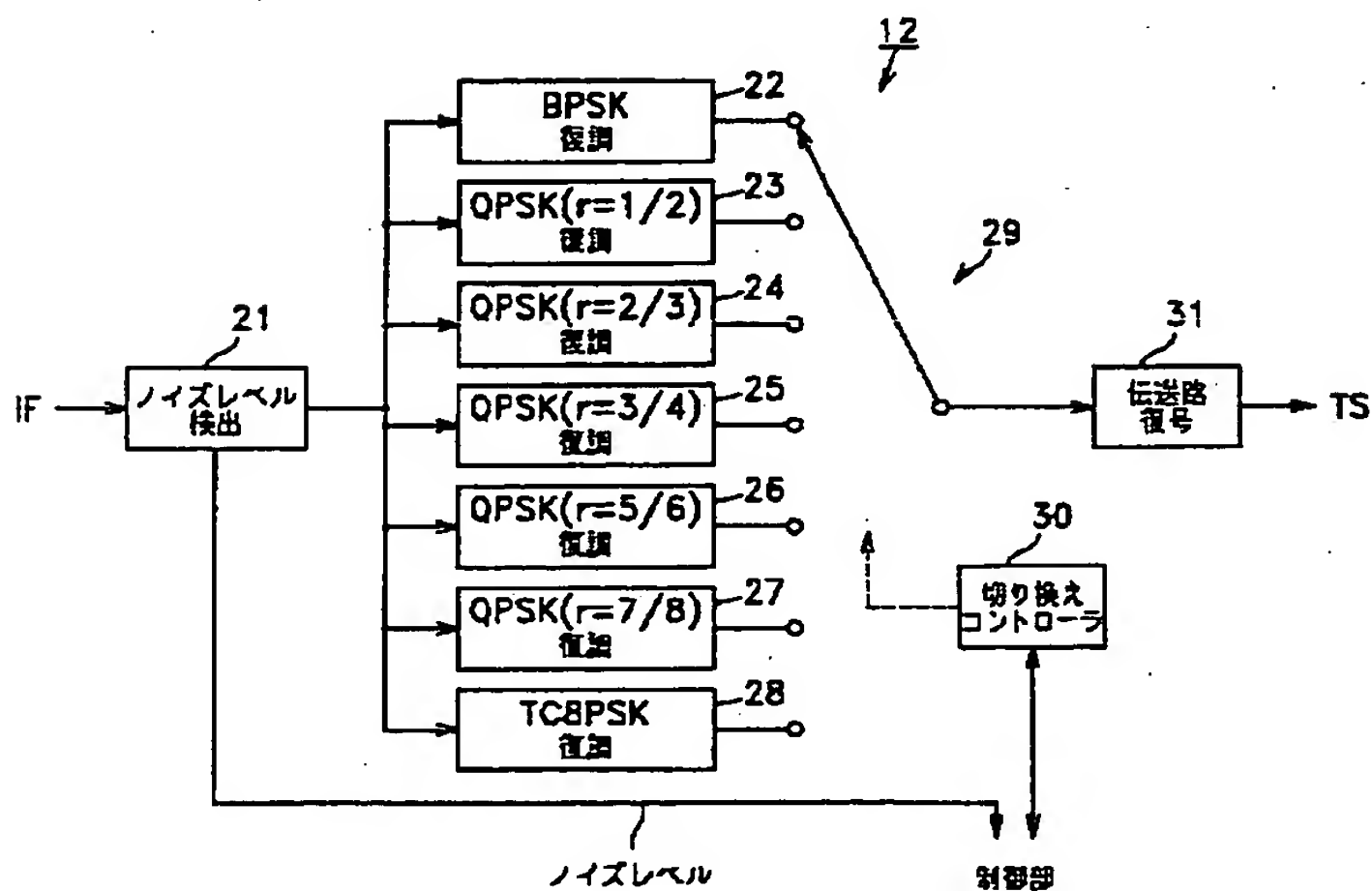
\* 1 BSデジタル放送受信装置、2 パラボラアンテナ、11 選局部、12 復調部、13 デスクランブラ、14 TSデコーダ、15 MPEGデコーダ、16 制御部、17 ノイズレベル対C/N比テーブル、21 ノイズレベル検出部

\*

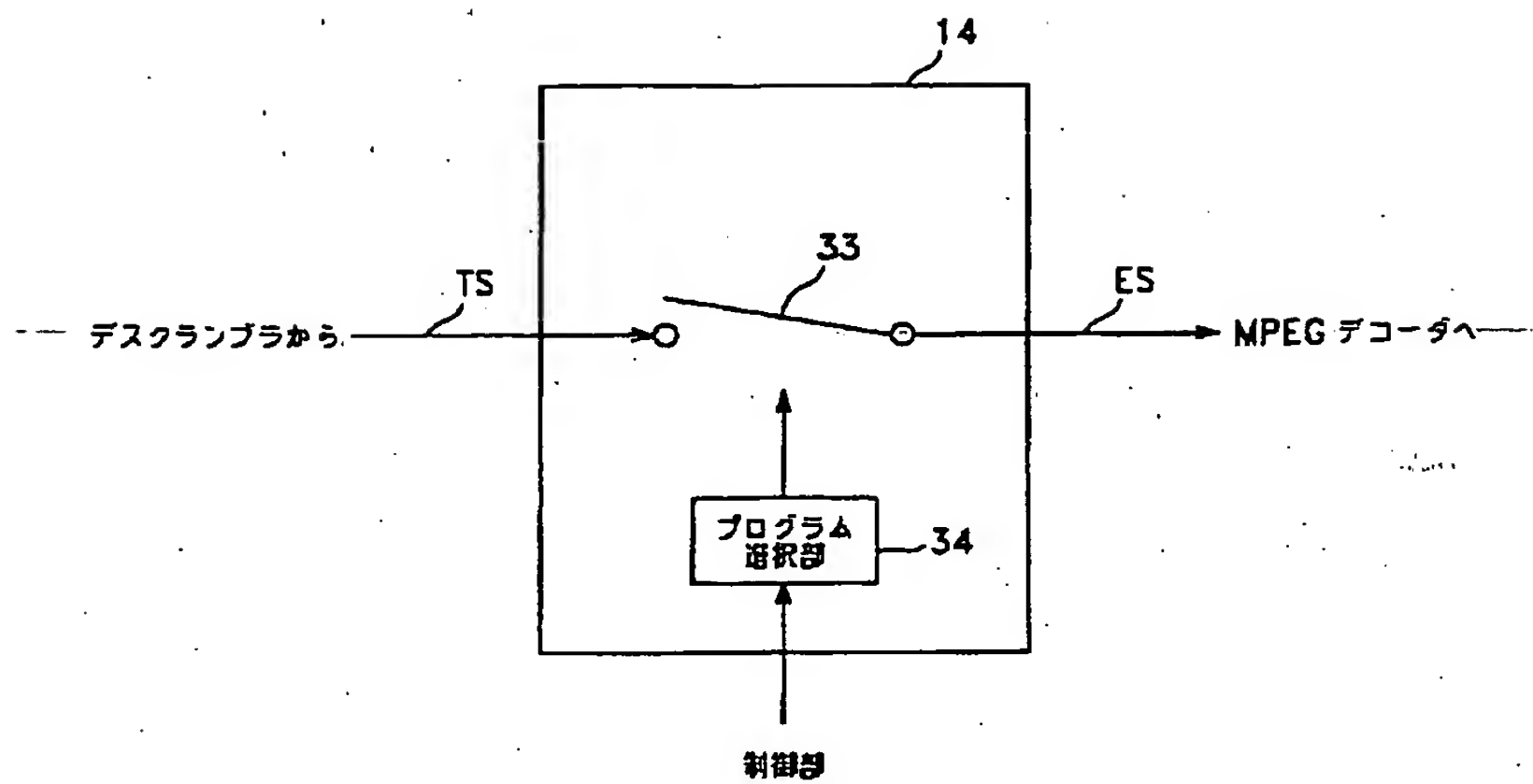
【図1】



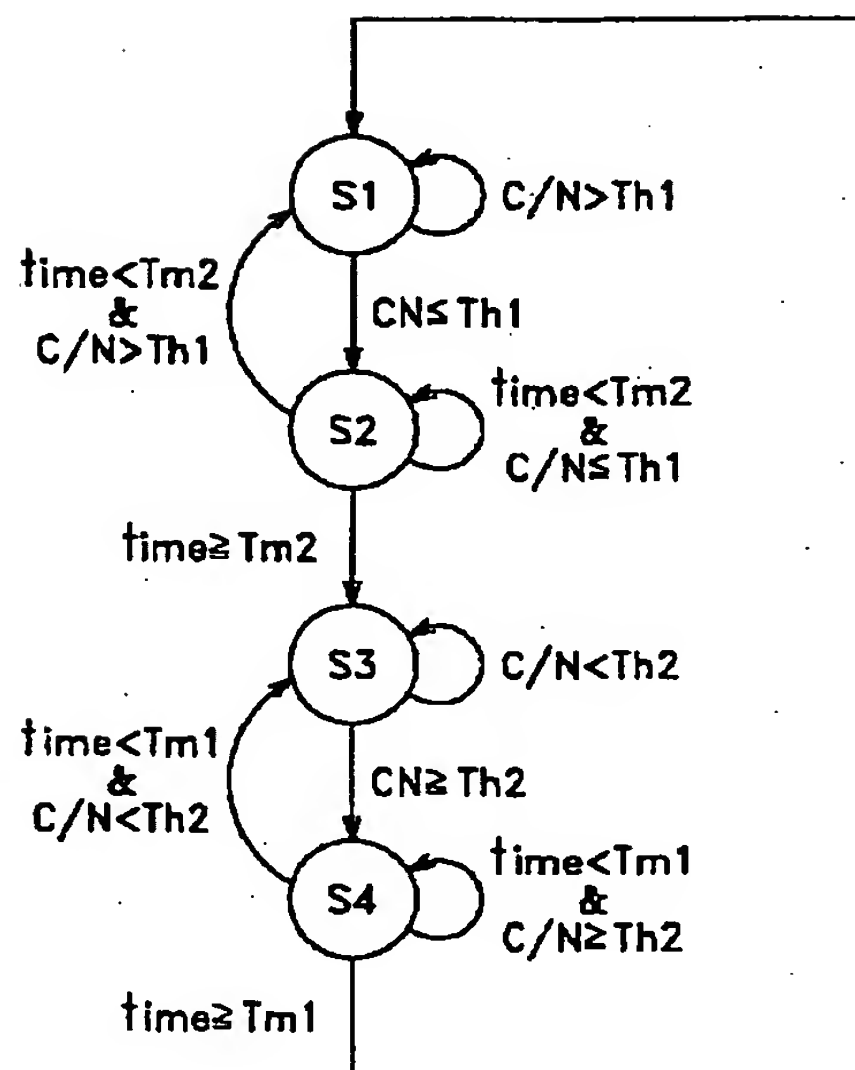
【図2】



【図3】



【図4】



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